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ZYMOTIC DISEASES

Considered with Reference to their
Cause, Extent and Prevention.

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ZYMOTIC DISEASES CONSIDERED WITH REFERENCE TO THEIR CAUSE, EXTENT AND PREVENTION.

BY R. FRENCH STONE, M. D., INDIANAPOLIS.

Zymotic disease has been defined by our leading medical authorities as any epidemic, endemic, contagious or sporadic affection which is produced by some morbid principle acting on the system like a ferment. It is now generally conceded that the peculiar and mysterious process of zymosis acting presumably upon the blood causes profound changes in the system, and produces widespread constitutional affections among the human race throughout the world. We have two theories in regard to the initial factors of the zymotic process. The one which seems to be the most generally believed in is known as the *cryptogamic* or *bacterian* method of development. But recent speculation and the alleged discoveries as to the origin of certain *specific diseases* in certain minute *vegetable* organisms is still unproved, and has no basis except the barren and absurd analogy that such diseases may be propagated like plants or animals. It is a theory which assumes that disease is an *entity*, and no matter how powerful are the predisposing causes of disease, or how susceptible individuals are to the invasion of disease, it can not be established until a certain vegetable organism has gained entrance from *without* the system, and that the character of disease is then determined by the form of the vegetable parasite which may then be discovered. In this connection it is fair to state that while the theory of the mycophytic origin of specific diseases has met with a widespread popularity, it promises to be of brief duration. It has failed to meet the indorsement of many of the leading medical men throughout the world, and in fact an earnest skepticism prevails among many prominent medical scientists as to the real significance of micrococci, bacilli, etc. Their existence in the blood at the outset of disease is denied. Their development a few hours after death is conceded, but their appearance is considered as the result of decomposition, showing nothing as regards the specificity of constitutional infectious disease. The bacillus tuberculosis of Koch, to which so much importance has recently been attached, is *fast losing its diagnostic and prognostic significance*, as it has been found in the non-tuberculous, affected with bronchitis, pneumonia, etc., and shows nothing as regards the specificity of disease, and thus far has led to only visionary and impracticable measures of sanitation or treatment. The discovery of the part played by certain vegetable parasitic organisms in the etiology of certain *local* diseases is fully recognized; but the analogous explanation of the origin, development and transmission of *constitutional* infectious disease is to be rejected. The etiological influence of such agencies in the production of the latter class of maladies must soon or late be looked upon as a fallacy and a delusion, and which, by ignoring and supplanting the known factors of disease and the application of appropriate hygienic or curative measures of treatment, as deplorably misleading and impracticable. Viewing the causation of zymotic or constitutional infectious diseases from the standpoint of physiological perturbation, the writer believes that the only "germs" that should be recognized as an etiological factor in this class of maladies are those which are natural to and evolved from the animal body itself while subject to the influence of abnormal conditions, and that all others found



(such as the various forms of vegetable organisms) are the effect and not the cause of disease. The reader will observe that while both the theories enumerated may be called "germ theories," that they are widely different in many respects. The first embodies the idea that the true disease germs are entirely foreign to the body, and received into it from without, in fact parasitic vegetable organisms. The second attempts to define the origin, development, progress and transmission of zymotic disease by means of living germinal cells, normal to and evolved from the animal body itself, and which, so far as facts of growth, movement and proliferation are concerned, correspond in power and properties with the lymphoid cells, or white corpuscles of the blood, and which may, in fact, be considered as identical with these bodies. The published microscopical demonstrations and investigations of Beale, Sanderson, Bastian, Richardson and others, seem to render this the most reasonable and conclusive of all the so-called "germ" theories hitherto promulgated for the elucidation of the etiology and pathogenesis of this class of maladies.

INFLUENCE OF "WASTE" PRODUCTS IN ZYMOTIC DISEASE.

It is known that during the visitation of the severest epidemics of infectious disease, that the number attacked is, in reality, small in comparison to the entire population, and it is unquestionable that a large proportion of those who are as fully exposed as those attacked by the disease do not become the subjects of it. It is evident that there must be some "predisposing condition" which determines zymotic action in the individuals who manifest its effects. This fact has been recognized by all who have at various times scientifically studied the etiology of epidemics, and it has been universally noted that unwholesome food, bad water and foul air have exerted a singular potency in favoring *zymosis* on individuals and communities. But the most common condition which all these agencies tend to produce, which experience has shown to be especially favorable to the development of zymotic disease, is the presence in the blood of the individual attacked of an *excess* of those decomposing, effete matters with which the circulating current is normally charged to a limited amount during their passage from the parts of the body in which they are poured into it to the excretory organs by which they are eliminated and cast forth. If the amount of these matters be limited to that which is being continually generated in the ordinary waste of the body, and if the great emunctories (the lungs, the liver, the intestinal glandulæ, the kidneys and the skin) all do their proper work, the products of that "waste" are drawn off from the blood current as fast as they are poured into it, so that the nutrient fluid is kept pure. But if, on the contrary, such decomposing matters be either abnormally introduced from without, or be generated in abnormal amount within the body, or if, on the other hand, the normal process of elimination be in any way obstructed; or if, still more, an abnormal excess of the one process concurs with deficient activity of the other, a rapid accumulation of these matters takes place in the blood, and then by providing the *pabulum*—nitrogenous matter in a decomposing or readily decomposable state—supplies the very condition, both in cause and effect, necessary to complete the cycle of morbid activity. Of the effectiveness of the *introduction* of putrescent organic matter, either in food, water or air, the cholera epidemics of former years afford the most ample proof "Of even more marked potency of the *excessive generation of effete material within the body*, we have a typical example in the extraordinary proclivity of *puerperal female* to suffer from the action of any septic poison to which she may be exposed." Nothing can be plainer to the physiologist (says the late Dr. Carpenter, of London) than that the

return of the uterus, after parturition to its non-pregnant condition, involves a rapid "waste" of its muscular substance, the products of which will be poured into the blood current far more rapidly than can be eliminated, this state being continued until the process is completed. The like condition exists in subjects of *severe injuries* and *surgical operations*, and not only do these exhibit a special proclivity to the action of specific poisons like scarlatina, but they show a peculiar liability to suffer from the ordinary septic poisons which have no effect upon the healthy carriers of them, erysipelas and adynamic "surgical fever" being then communicable. *Excessive exertion*, again, whether bodily or mental (such excess being marked by the *sense of fatigue*), has always ranked among the most potent predisposing causes of zymotic disease, and its action is clearly traceable to the same source, the abnormally rapid "waste" of the tissues, whereby the blood current becomes unduly charged with the products of their disintegration. It is within the experience of every one that the *sense of fatigue* bears no constant proportion to the amount of exertion put forth, and that an unusually severe and prolonged strain may be sustained without its induction, when the excretory apparatus is stimulated to increased activity; and, on the contrary, any obstruction to the eliminating processes (as bad ventilation of the sleeping apartment), preventing the removal of "waste products," develops this sensation to a marked degree. There is strong reason, therefore, for regarding this feeling as indicative of the degree in which the blood is charged with the products of *nervo-muscular "waste."* Ample evidence is afforded by army experience of the special liability of soldiers to zymotic diseases when on long and fatiguing marches; and this especially in hot climates, where the activity of the respiratory process, being reduced by the high external temperature, the products of the "waste" tend to accumulate in the blood current.

Of the tendency to zymotic diseases, induced by the accumulation of effete matter consequent upon *obstructed elimination*, we have a marked example in that which results from *overcrowding*. "The effect of defective air supply is not only to reduce the quantity of carbonic acid got rid of by expiration, but also (which is probably of greater importance in relation to zymotic disease), to diminish the *normal oxidation* of those nitrogenous effete matters of which (when thus metamorphosed) it is the special function of the kidneys and the skin to eliminate." The accumulation of these waste products within the body speedily makes itself manifest in the offensiveness of the *halitus* of respiration (the condensation of the breath showing the presence of fetid matter), and the same condition existing in a marked degree with reference to the cutaneous, renal and intestinal excretions; and then, although there may be no introduction of decomposing matter into the body, or specially rapid internal production of it, the blood-current becomes as effectually charged with the *pabulum* of the *zymotic poison* as if this had been directly injected into it.

There is one factor in zymosis which we fear is too much overlooked, even by the medical profession. We refer to the strong predisposition to zymotic diseases induced by *intemperance*. For the *habitual presence of alcohol*, a readily oxidizable hydrocarbon in the blood-current, undoubtedly diminishes the oxidation of the waste products of the system, and thus occasions their accumulation as effectually as from overcrowding; and this result will occur sooner in a hot than in a cold atmosphere on account of the reduced activity of the respiratory process in the former. Where, again, the rate of "waste" is abnormally increased, as during protracted physical labor, the evil influence of alcoholic liquors is still more strongly manifested, and this will be again aggravated by overcrowding in ill-ventilated apartments. The connection between *famine* and *pestilence* is another argument in favor of the fact that a state of general blood contamination is produced

by the accumulation of the non-eliminated products of tissue metamorphosis. When people are suffering from starvation, the vital powers are too *depressed* to carry on the normal excretory functions. The fetid excretions from the skin, the rapid supervention of general putrescence after death, and its manifestations even previously, and the frequent termination of life by colliquative diarrhea, all evidence the peculiar fitness of the body so conditioned for the development of a zymotic disease, or in augmenting the severity of the attack, as well as in lowering the healthy vigor of the body generally, by which individuals are rendered more easily affected by all those diseases to which they may be *constitutionally* liable.

Where any form of malnutrition exists, whether resulting from imperfect performance of the primary digestive processes, producing ill-made blood, or from imperfect conversion of blood into tissue, there must be premature degeneration and augmented waste, and the rate of this augmentation must tend to increase, if special *attention* be not given to the *eliminating* processes. The fundamental importance of pure fresh air (as cool as can be borne) to the scrofulous subject, and the remarkable cures sometimes effected in individuals in whose lungs tubercular deposits have already commenced, by the hazardous discipline of a hardy out-door life, can be easily explained upon sound physiological reasoning. "When any serious malady has once established itself the degeneration of tissue, as shown by the rapid wasting of the body, takes place with augmented rapidity, and the necessity for the removal of its products is proportionately urgent. And this is no less important when the progress of the disease is stayed, for the purification of the blood from the contamination it has received is absolutely essential to the establishment of those recuperative processes on which the final issue depends. Of the due elimination of the waste products their *oxidation* is the first and most fundamentally important act, and of the direful consequences of past ignorance and neglect of this principle, evinced on a large scale in the overcrowding and bad ventilation of the tenement buildings, hospitals, poor houses and prisons, their records and sanitary investigation too surely demonstrate." And even now our supervision is far from perfect in this particular, and we may safely affirm that not only the public but the medical profession have still much to learn as to the importance of pure air, and of wholesome food and drink, for the *prevention* as well as the cure of disease. On careful study of these circumstances we must admit that we are thus furnished with a scientific *rationale* for all that experience has taught as to the conditions for the development and spread of zymotic disease, which, by giving greater definiteness and consistency to medical doctrine, will afford a surer and more positive basis for preventive hygiene, both public and individual.

THE SPECIFIC CAUSES OF DISEASE.

By specific causes are meant those which not only engender distinct diseases, but which are supposed to be the *only* causes of the maladies which follow their application respectively. But some affections, which belong to the zymotic class of diseases, which are ordinarily supposed to arise from a particular cause and from that alone, do in exceptional cases proceed from another cause. Thus several diseases, whose rule of propagation is from individual to individual, in exceptional cases appear to be spontaneously generated, and still more, upon the other hand, those which seem to be of atmospheric origin are at times undoubtedly disseminated by contagion. Experience and observation teach that many diseases of this class are autogenetic and in no sense derived from an antecedent disease of

the same kind. This view is especially applicable in regard to such an affection as erysipelas, which, although certainly contagious, is also on very good grounds judged to be generable, especially during certain states of lowered health, induced by renal disease and some other visceral affections. Though not so certainly known, it is by many deemed probable that a similar conclusion may be held in regard to more generally contagious affections, such as diphtheria, typhoid and typhus fever, scarlatina and cholera, which, though certainly contagious, may also be autogenetic, or developed from bad hygienic environments. Among zymotic diseases we might still further mention several others, which, although their ordinary or normal mode of spreading is by contagion, yet, beyond reasonable doubt, do sometimes arise spontaneously, and, notwithstanding the arbitrary assertions of the followers of Koch and Pasteur, this is probably the case with yellow fever, small-pox, gonorrhea and syphilis, and unquestionably so in regard to hydrophobia and glanders, the latter diseases in fact being only of *spontaneous origin* in the lower animals, from which they are communicated to man.

The so-called "specific" cause of disease has ever been one of the most mysterious questions that the medical mind has attempted to explain. It is true that the advocates of the "bacterian" theory of diseases claim that certain scientists and microscopists, laboring and investigating outside the domain of medicine, have demonstrated the specific cause of three diseases, splenic and relapsing fever and tuberculosis, and while it is also true that two-thirds of the field of recent medical literature has been occupied in promulgating this visionary hypothesis of pseudo-medical men, and while notwithstanding the attempt is now being made to establish and endow chairs or professorships in certain medical schools to further the interest of this novel doctrine, yet it should be said to the credit of the great body of our profession that it is not yet disposed to receive as admitted fact that which is as yet but simple conjecture. It is not yet disposed to cast aside all that long experience and observation has taught in regard to the many potent etiological factors in the development of zymotic disease, whether relating to those of a general predisposing character, such as seasons, climate, locality or the temperature, or hygrometric condition of the atmosphere, or the effluvia which it holds in suspension, or those special predisposing causes relating to the temperament, constitution, occupation and habits of life, or hereditary influences to which the individual may be subjected, or those acquired predisposing causes having reference to food and drink, and those due to defective excretion, already enumerated, and proclaim to the world that all these influences are to be disregarded as inoperative, and that we have nothing to fear from this class of maladies so long as the system is not invaded by those low, self-multiplying vegetable organisms sometimes found in the depraved excretions of those subject to this class of diseases. And its skepticism has been still further strengthened by the fact that such organisms have been found where no disease existed, and in some of the most infectious maladies their presence have not been demonstrated. And admitting the fact, says Bastian, that they have often or generally been seen in the morbid products and tissues of persons with zymotic disease, this would not by itself be a proof or nearly a proof that bacteria are causative of the morbid change, for obviously they might be mere attendants on the necrosis and decomposition of bodily material availing themselves of the process, just as certain insects would, to feed and multiply; and, as a matter of fact, where such organisms have been seen in morbid material, no direct proof can be given that the meaning of their presence is more than this.

THE NATURE OF CONTAGION.

It may be affirmed that we know nothing yet as to the specific poison, if we may so call it, which produces scarlatina, yellow fever, or cholera. The chemist can not detect in the atmosphere the causes of those infectious diseases which spread only through this medium, or chiefly in this way, nor can he with certainty detect any peculiar substance in the blood of the most pestilential malady other than the proliferation of its normal cell elements, or that due from the contamination of defective excretions. Neither by the microscope nor by the minutest chemical analysis, can we distinguish the pus globule of small-pox or of syphilis from the most laudable pus of the surgeon. Nothing distinctive has yet been seen in the lymph of fresh vaccine fluid, nor has the most delicate tests as yet shown anything especially abnormal in the saliva of a rabid animal, by which specific diseases of this class are communicated so certainly and positively by direct contact. The *materies morbi* of these diseases in our present state of knowledge is still an unsettled problem. At all events, in the vast majority of infectious and contagious diseases, the poisons by which they are called into activity are as yet unseen and unknown. Spectroscopic examination of contagious fluids, anatomical alterations and microscopic and chemical study of the blood upon the living and the dead having furnished no notions sufficiently precise to draw any practical deductions, having furnished little or no positive evidence toward elucidating this question, it is not yet possible to say what is the *essential constitution* of "contagious matter," or what is the intimate nature of the transforming power which the particle of such matter exercises on the particles which it infects. Nor are we able, by actual demonstration, to say that contagion is a *material substance*. We know that the ancients, in investigating the nature of *heat*, regarded it at first as a kind of subtle matter which insinuates itself into the substance of bodies, and resides there with greater or less manifestation of its presence; but that heat is now regarded and proved by scientific observers to be not a material substance, but simply a *condition* of matter, a *force*, or a molecular motion, and from the nature of its action *contagion*, like the *force* caloric, appears to us to be a mere *condition* of matter, and not a material substance. And in that most interesting but most difficult and hitherto almost uninvestigated branch of chemical dynamics we are supposed to have our nearest clue to the scientific problems connected with the subject under consideration. Hence, any theory which tends toward a more clear explanation of the *rationale* of these processes becomes a matter of great interest. The theory which we present assumes the identity of the physical and vital forces. The physical forces embrace magnetism, chemical affinity, heat, electricity, and motion. The so-called vital forces are, assimilation, combustion, animal heat, nerve force, and muscular contractility. All scientists now concede the correlation of the physical forces; that they are convertible the one into the other, and that force, like matter in any form, can neither be created nor destroyed, and as presented to us in the universe, they are both indestructible and inseparable, perpetually existing and unchanging in quantity yet ever changing in form. The ultimate nature of force, however, is the greatest mystery of nature, visible only in its effects as revealed to our senses. We can only judge of its presence by the peculiarity of its action and the effects which it produces.

If we accept the teachings of modern science, all matter is the vehicle of change, motion the result of change, and *force* the cause of change. Life, as we understand it, depends upon the presence of a material substance operated upon

by force resulting in movement, and the harmonious interaction of these conditions, when applied to the animal body, would not only constitute life, but health—while its derangement would as surely eventuate in disease and death. According to the demonstrations and conclusions of modern investigators of physical science, the “*vis viva*,” or life force, is simply the combined influence of this physical force which is constantly changing its form in the so-called vital processes, while its supply is maintained by the food we eat, the fluids we drink, and the air we breathe.

Thus, for example, the nutrient fluid charged with oxygen is placed in an electro-positive; at the same time the tissues are in an electro-negative, or magnetic, condition, by which assimilation (or chemical affinity) is induced; this involves combustion, oxidation and molecular motion. Molecular motion is converted into (animal) heat, and heat is converted into (animal) electricity, or nerve force, and nerve force induces muscular contraction, or mechanical motion, which, in turn, serves to assist and perpetuate the operation of the other forces, in that it maintains the respiratory function, contracts the heart and arteries, propelling the blood to all parts of the system, and thus supply tissue waste, equalize temperature and maintain the secretory and excretory functions of the body. Such are the different manifestations of the so-called *vital forces*, the normal and harmonious operations of which constitute life and health; but when perverted will not only occasion disease and disorganization, but death, either local or general, as the conditions may determine. To illustrate: If the blood from any cause becomes contaminated or deficient in oxygen, the forces governing nutrition, such as assimilation and combustion, will be perverted in their operation, waste material, or *materies morbi*, will be developed, which may eventuate in morbid effects, such as malnutrition and disorganization of tissue of various degrees and varieties, according to the natural or acquired susceptibility of the subject; or the *materies morbi* thus accumulated may remain in a latent condition until equilibration is commenced by increased oxygenation, and then the increased oxidation augments the amount of animal heat within the body, causing fever, which may in its turn induce pathological lesions, which may vary in character with its *intensity*, ten degrees of which mark the difference between life and death. Force can only manifest itself by molecular motion, but it may exist in two general forms, known as potential energy and actual energy. Force stored up in certain conditions of matter, as in the tension of the particles of an explosive compound, as nitro-glycerine, or in a combustible body, such as wood, coal, and food of animals, is called potential energy—that is, power capable of being liberated for the production of effects. But when the nitro-glycerine explodes, the fuel is burned, or the food is oxidized in the animal body, the force they contain is given out in the form of effects produced, and the potential energy becomes actual energy, or in animal bodies living force. Such we hold to be the nature of unoxxygenized material in the blood, constituting *materies morbi*, in that it represents potential energy—becoming actual energy, producing morbid effects when subjected to zymotic action.

Force acting upon different forms of material substance will manifest itself in different ways—as chemical affinity, combustion, electricity, heat, etc. Also force in different forms acting upon the same material substance may give rise to a multiplicity of effects, as quantity and local conditions may determine. *But force operating in a certain direction, producing certain results, tends to continue in that direction and in the production of the same results so long as conditions favorable to its action obtain;* thus the molecular motion imparted to a conducting wire from a galvanic battery may continue for thousands of miles; a spark of fire may destroy a city, and so the smallest quantity of zymotic force which may be embodied in a mere trace of

serum, derived from the blood in a state of change, and thus conveyed by means of its own elements, may set up the same morbid action in other individuals whenever their blood becomes of a suitable zymotic condition, and sometimes giving rise to our widest spread and most pestelential epidemics. It is the operation of this law that gives us the *rationale* of contagion, and which confirms the opinion that it is a phase of force and not an entity. But we find—as in the physical forces, so in the vital forces; as in the great laboratory of nature, so in the individual organism—that action is met by counter-action, and that force, however manifested, sooner or later tends to equilibration. For this reason galvanic batteries become exhausted, fires must be fed with fuel, and zymosis ceases and disease ends in the infected individual and in communities when the material suitable for its action has been extinguished. Strictly speaking, therefore, contagion is a *morbid influence*, a perturbation of vital functions, and does not imply the existence animated germs any more than that of any other vehicle, vital or otherwise, which may serve to convey zymotic action. The essence of contagion is not a material substance, but a phase of force, imponderable in its nature, as heat, light, or electricity, specific only so far as it naturally tends to operate in the same direction upon the blood of another individual, when it contains certain constituents identical in character with those upon which it has been operating in the blood of the infecting individual. And it appears reasonable that the “specific” or determining causes of infectious disease involve an acquired personal predisposition for their development, an essential condition of which is the accumulation of “waste” products—of azotized or un-oxygenized material within the blood due to defective excretion or other causes already mentioned, and if such material be retained in the system a sufficient length of time, or exist in a sufficient quantity, it may itself assume a state of change, or induce a condition of change in the normal cell elements of the blood and thus give rise to an autogenetic origin of disease, which, when of sufficient virulence, may reproduce the disease by *contagion of zymosis* in another individual, provided his blood is in a similar abnormal condition, which is likely to be the case when individuals and communities are alike subjected to the same general and special predisposing causes of disease. And it would seem possible that while the force zymosis generally induces disease identical to that from which it originates, it might yet establish a zymotic action sufficient to engender other diseases, and in case we assume the nature of zymotic force to be common to all of the infectious maladies, still its effects would differ as other factors might determine. Thus the degree of virulence and the types and varieties of infections would then depend upon the present condition of the individual, his powers of constitution, age, susceptibility, weakened condition of certain organs or tissues from previous diseases or tolerance from like causes, as well as the character of the defective excretion, its degree and the impression it has made upon the nervous system and nutritive functions, and also the route or channel by which nature attempts its elimination as influenced by that elective attraction or repulsion which one tissue or part of the body may have in excess over another for *materies morbi* in the blood. And for these reasons it would be possible, with a common contagion or zymotic influence and a common blood contamination, for one individual to be attacked with one form of infectious disease, and *one* another during the prevalence of a special epidemic, and thus not only afford an explanation of the tendencies of certain maladies to diversify in their characters, as well as the frequent prevalence of different infectious diseases at the same time, and in the same locality, but also those of different types to occasionally blend and merge the one into the other, or develop complications in individual cases—facts observed, but not otherwise easily accounted for.

Those who believe in the bacterian origin of infectious disease, tell us that a certain form of these organisms is required to act as the proximate cause of a certain disease, but they have never yet explained why this is the case. The theory which the writer advocates and which has been more fully set forth in a recent publication (*Elements of Modern Medicine*), attempts to explain the specificity of disease upon physiological grounds. His conclusions are, that as the normal cell elements of the body become poisoned through defective excretion, it necessarily follows that the character of an infectious disease depends upon the variety or nature of that glandular excretion which is most defective; and hence it also follows that when these normal cell elements become poisoned by an excrementitious material which has accumulated in the blood, they are most prone to elimination through those glands whose defective function has produced the blood contamination, and thus explains the glandular involvement of infectious disease, and that zymotic affections are propagated and determined or made "specific" in obedience to the natural law of *elective attraction* which one tissue or part of the body has over another for the normal germinal or tissue-building cells of the blood, on the one hand, and on that *repellent force* exercised by various excretory glands by means of which material unfit to serve the purpose of nutrition is eliminated from the system. Hence it necessarily follows that in any so called specific disease these embryonic cells for special tissues, now infected by the general toxic condition of the blood from "waste" material becoming unfit for assimilation, may yet remain living, organic germs, capable of *proliferation* or *multiplication*, and thus by their presence and final regressive metamorphosis or elimination, produce, in part at least, those lesions which characterize the particular forms of infectious disease. And should these semi-vitalized, normal germinal cells, subject to this *morbid* or *zymotic* influence or while undergoing this regressive change, be transplanted to another individual, whose blood is also contaminated with excrementitious material favorable for its continuance, similar phenomena and lesions are liable to be developed as were present in the individual from whom these diseased germinal particles have been derived. These morbid cell elements charged with excrementitious material being still under the dominance of the natural laws of *elective attraction* which appropriates certain elements to certain tissues or parts of the body, or that normal repellent force peculiar to certain excretory glands, secure their deposition in those localities or ultimate elimination (if the patient survives) through those excretory organs and parts of the body identical with those from which they have been derived. And thus again are stamped upon the disease its "specific" characters.

It is evident that if the above views be correct that the "waste" products constituting the *initial factor of the zymotic process*, not only exerts poisonous influence upon the nutrient elements of the blood, but also upon the nerve centers as well, in consequence of which many diseases of this class are known to manifest a periodicity in their symptoms and their course, which seems to be in obedience to what observation teaches concerning that general law of periodicity which regulates all the vital movements. If we inquire into the causes of these periodical changes, we find reason to believe that they are in part dependent upon cyclical processes inherent in the system, and partly upon periodic agencies acting from without, or that resulting from a combination of the two. With regard to the external agencies it is to be remembered how closely the periodical changes connected with the vital movements are linked to the periodic phenomena observed in nature at large. Thus digestion and fasting, wakefulness and sleep, correspond with day and night, light and darkness, and its accompanying changes of temperature. It is known that vital activity is at its lowest between the hours of 1 and 3 A. M. After 3

A. M. the activity increases, at first slowly, and then more quickly, until a maximum is reached between the hours of noon and 2 P. M. A progressive decline follows, rapid at first, slower as the evening draws on and falls into night, until the minimum again is reached between 1 and 3 A. M. These influences, of a periodical character in health, not only tend to invite or resist the invasion of disease at such times, but continue to exert their impression in morbid states of the system by intensifying disease at certain times and lessening its effects at others, either as the activity of the vital forces may be greater or their excitability diminished. Most, if not all, paroxysmal attacks of zymotic disease are probably due to the gradual accumulation of contaminating material in the blood from deficient excretion. This, in the so-called malarial affections, within a certain length of time, will begin to exert a toxic influence upon the nerve centers, ordinarily producing rigor, fever and sweating, or culminating in some other eliminative action, and these morbid phenomena will be repeated at certain definite intervals corresponding with the rate of *re-accumulation* of the blood poison, and partly with the state of excitability of the nervous system. Reasoning from this standpoint, it is fair to assume that prophylactic or medicinal agents may act as anti-periodics in one of three ways: (1) by increasing the activity of the excretory functions, as by the use of emetics, cathartics or diaphoretics; (2) by blunting the excitability of the nervous centers, by the use of narcotics given before the expected paroxysm, and (3) by bracing up the nervous system during the intervals of the paroxysms by the use of quinine, arsenic, and other excitant neurotics, until nature, assisted by other means, can have time to eliminate the *materies morbi*, or else to enable the system to become tolerant to the toxic element in the blood, which exerts a causative influence. It is evident, therefore, that the remedies of the first division are the only ones pathogenetic in character, the other being symptomatic, not specifics, not chemical antidotes to malarial infection, but their action is due to a physiological antagonism, valuable in that they act upon the nervous system in an inverse sense to the morbid influence, and thus serve to annul its effects and counteract or prevent its more dangerous consequences.

EXTENT OF ZYMOTIC DISEASE.

The term *zymotic* has been admitted into standard medical nomenclature as conveniently expressive of the elements or factors giving rise to many of the conditions incident to infectious disease, and is, therefore, employed to designate all those diseases which can be communicated from existing foci, or which are capable of being prevented by hygienic or other conditions. As has been stated, this class comprehends those disorders which appear to involve a morbid condition of the blood, and which present, for the most part, but not all of them, the following characters: They run a definite course, are attended by fever, and frequently by eruptions of the skin; are more or less readily communicable from person to person, and possess the singular and important property of generally protecting those who suffer them from a second attack. They are apt to occur epidemically, and some of them manifest a tendency to transmission by inheritance. The latest and most approved nosology includes over twenty of our principal diseases in the zymotic class—such as small-pox, measles, scarlet fever, diphtheria, croup, whooping-cough, the *essential* fevers (including typhus, typhoid, cerebro-spinal, yellow fever, and the different forms of so-called malarial fever), quinsy, erysipelas, puerperal fever, carbuncle, influenza, dysentery, diarrhea, cholera, rheumatism, pyæmia, etc. The reports of the Registrar General of England show that about one-fourth of the

whole number of deaths is from zymotic disorders. An examination of the returns of the Surgeon General and of the Marine Hospital Bureau, as well as the health reports from the principal cities in the United States, will establish about the same ratio; and if we include tuberculosis and pneumonia in this class of maladies (and they certainly fill the essential conditions of zymotic disease), we find that the mortality is more than fifty per cent. of that which occurs from all causes.

An examination of the volume devoted to mortality and vital statistics of our last United States census, 1880, shows that our total mortality for the year was 756,893. Of these more than half died from zymotic disorders, as may be set forth in the following table:

ANNUAL DEATHS FROM ZYMOTIC DISEASES IN THE ORDER OF THEIR FATALITY.

Consumption	91,270
Pneumonia	63,053
Diphtheria	38,143
Cholera infantum	24,983
Enteric fever	22,854
Malarial fever	20,231
Croup	17,966
Scarlet fever	16,388
Dysentery	13,427
Enteritis	12,640
Whooping cough	11,064
Bronchitis	10,984
Diarrhœa	10,825
Measles	8,072
Septicæmia	5,828
Scrofula	5,000
Erysipelas	4,275
Rheumatism	3,399
Cerebro-spinal fever	2,898
Cholera morbus	2,116
Venereal diseases	1,217
Small-pox	871
Other diseases of this order.	12,474
Total.	402,897

There are 1,146 diseases which affect mankind and require the study and attention of the physician, but less than twenty-five of these diseases, all of which are zymotic, are known to cause nearly two-thirds of the total mortality. Every intelligent physician will admit that, by the application of the well-established principles of sanitary science, we have absolute power to either wholly prevent or mitigate every one of these maladies. Let any medical man examine closely the above table, and he can not fail to be amazed at the mortality from avoidable diseases, as compared with those which are non-avoidable. Let us consider these diseases briefly in the order of their fatality.

CONSUMPTION.

Of all the diseases affecting the human race, tuberculosis is the most general in prevalence and fatal in results. It may be developed from hereditary predisposition, but a bad hygienic influence is acknowledged to be a far more potent cause, the chief factors of which are foul air, exposure to cold and wet with insufficient

food and clothing, unhealthful avocations, damp soils, syphilis and alcoholism. The influence of soil moisture in the production of consumption is no theory—it is a demonstrated fact. It has been shown by Dr. Bowditch, of Massachusetts, and Dr. Buchanan, of England, that soil moisture and soil pollution are directly causative of this disease, as well as many other zymotic disorders. It is for this reason that New Orleans, with all its climatic advantages, shows a higher death rate from consumption than any other city in America. Statistical observations extending over a number of years have amply proved the beneficial effects of partial or thorough sewerage and drainage in many of the principal towns of England, the reduction of mortality from this malady varying from eleven to forty-nine per cent., according to the thoroughness with which this sanitary measure was carried out.

PNEUMONIA.

This affection produces a higher death rate than any other except the one last mentioned. It deserves a place among zymotic diseases, as it is now recognized as a general and not a local affection. Its cause and its course is closely related to the essential fevers. Like croup, bronchitis, and pleurisy, it is mainly a disease of temperate climates, and its chief cause is exposure to inclement weather and residence in a damp locality. It is known to be more common among the poor and badly fed, and among those whose occupation necessitates an irregular mode of life and great exposure, than among those otherwise better circumstanced. It is also known to affect those who breathe an impure atmosphere and who are constitutionally weak, and those whose general health has been impaired by some temporary bad hygienic influence, rather than the strong and vigorous, favored by proper sanitary environments.

DIPHTHERIA.

This disease ranks third in its degree of fatality. It is eminently contagious, and the importance of strict isolation of those affected can scarcely be overrated. Apart from endemic and epidemic causes affecting its maintenance *in foci*, and its outbursts at particular times and in particular places, there are etiological influences belonging to individuals not to be overlooked, such as poverty and its concomitants, unventilated, filthy lodgings, scanty clothing and imperfect alimentation, which may not only serve to develop but impart a receptivity for the contagion of this disease. A similar receptivity exists in tuberculous persons and in all cachectic subjects. Scarlatina, measles and whooping cough peculiarly predispose to diphtheria. This is especially true of the former disease. Recently delivered women receive easily the diphtheritic poison. During epidemics the influences of the predisposing causes are strikingly exemplified. While the malady can not be regarded as a hereditary disease, yet observation teaches that a special aptitude to receive and develop the poison evidently pertains to certain individuals and families. It is most common between the ages of two and ten. Few persons are attacked after thirty; but there are occasional victims at all ages, from the earliest infancy to old age. According to our last census about 20,000, or more than half the annual deaths from this malady, occur with children under five years of age.

CHOLERA INFANTUM.

This malady follows next in the order of mortality. Over 16,000 annually, or more than two-thirds of all deaths from this affection, occur with infants under one year of age. How shall we account for this amazing and unwarrantable loss

of human life, for this vast number of children dead before the first anniversary of their birthday? Shall we say that thousands upon thousands of precious, helpless infant lives are yearly offered as holocausts upon the altar of man's ignorance or carelessness? In considering diarrheal diseases of infants, it must be remembered that the most powerful factor in their production and fatality is that of artificial feeding, and that the mother's breast is the generous, sympathetic fount from which should flow the nourishment for the babe. It has become fashionable in some circles of society for the mother to shrink from and shirk the high and solemn duty of nursing her own infant; a diseased or filthy wet nurse or a half-starved and tuberculous cow, fed on slops or garbage, is inducted into the office of feeding the child, and when it is well nigh dead from inanition, it is fed on farina and the numerous forms of infants' food with which the country is flooded. Where there is no other excuse for this than the dictates of fashion, or a matter of convenience, it is well said to be a species of moral depravity and inhumanity lower than the instinct of the brute, which always tenderly nurse and defend their offspring.

ENTERIC FEVER.

This disease stands fifth in the degree of fatality, the annual death rate being nearly 23,000. It has been very truly said that of all diseases which are attributable to filth, that this may be proclaimed as the very type and quintessence; though sometimes by hidden processes, yet far more frequently in the most glaring way, it apparently has an invariable course in that which of filth is the filthiest, and that most generally its infection runs its course, as with successive inoculation from one individual to another by instrumentality of the molecules of excrement which have been allowed to mingle with air, food and drink. We do not desire to be numbered with those who entertain the opinion, however, that typhoid fever is so "specific" in its nature that it can only be derived from a pre-existing case of the same disease, but believe that it may be developed by fermentation of fecal matter independently of any specific germ introduced in typhoid evacuations. The outbreak of the malady in villages and in isolated buildings where the causes can not be traced to any previous case of the disease warrant this conclusion. Fortunately, however, for the bacillus theory of Budd or Klebs, or the pythogenic hypothesis of the late Dr. Murchison (that this fever may be developed anew by the decomposition of sewage, and perhaps of other forms of animal filth), the practical issue of both views is the same, namely, that the great preventive measures are the prompt removal of fecal matters and other forms of animal decomposition, so that neither air nor water may be contaminated by them. But it is also well-known that individual susceptibility to the disease, and certain predisposing causes, are potent factors in its development and dissemination. It is a matter of common observation that some persons never contract typhoid fever, however much exposed, while others take it readily, and it is almost equally clear that certain families are extremely susceptible and liable to have the disease in a severe form, and that a formidable attack is to be apprehended if either of the parents have died of the fever. This affliction may occur at any age, but is very rare in advanced life. It is probably more common in infancy than is generally supposed, as it is easily overlooked or confounded with common infantile ailments. The period of life at which the disease is most common is during adolescence and the first decade of adult life. Among the predisposing causes are mental anxiety, depression or shock, overwork, loss of sleep, lack of ventilation or sunlight and debility, however induced.

MALARIAL FEVER.

The annual mortality from diseases of this character is placed in our last census at over 20,000. Dr. Parkes has well said that when a climate is called "unhealthy," it is simply meant that it is malarious. The Italian word *malaria* merely stands for *bad air*, and may be employed to express the condition of the atmosphere when there is suspended in it any effluvia or abnormal constituent deleterious to the functions of animal life, whether this be an earth-born poison, generated in soils, the energies of which are not expended in the growth and sustenance of healthy vegetation, or whether the product of animal or vegetable decomposition. But the latter, in connection with the heat or moisture, has long been considered its most usual source. Malaria is, however, generated under conditions apparently widely different from the above. Fevers of this class have prevailed with destructive malignity in some of the most sterile regions of the earth, and in countries so dry and arid for want of rain as to cause all the rivers and other bodies of water to completely disappear. Neither do such fevers always increase in gravity and frequency as latitude diminishes. Tropical countries are often exempt, while in others of a high latitude they are known to prevail. They are found in Sweden as high as latitude 63°, and also on the shores of the Baltic Sea. In addition to other causes, unwholesome food, unsuitable drinking water, damp residences, the near presence of slops, garbage or defective house drains, bad ventilation, fatigue, exposure to atmospheric vicissitudes, such as the morning dew, the midday sun and the chill at night are most worthy of mention. That low, moist and warm localities are generally noted as malarious, however, is undisputed. The baneful effects of undrained soils in cities has already been cited. The unhealthful influences upon rural populations by residence near overflowed, undrained and swamp lands is also a matter of common observation. Hence we can not wonder that there is still an alarming prevalence of malarial fevers among the people in many portions of the country, making our population sallow, weakly, unhealthful, paralyzed in energy, and killing them by thousands with the preventable disease which is far more destructive to life than the deadly effects of yellow fever and cholera combined. In the etiological influence of undrained lands we not only have a waste of productive energy, health and life, but the reclamation of such lands would add millions of acres of our richest soil to our cultivable area which, under intelligent tillage, would afford sustenance for a population four times as large as what it is at the present time.

CROUP.

The annual mortality from this disease is nearly 18,000. About one-third of this mortality is with children under one year of age, and almost the entire number of deaths occur with those under five years of age. The disease referred to in this connection is intended to designate pseudo-membranous laryngitis, which is considered of a diphtheretic nature. Its most common cause is cold and moist air, mainly during a prevalent epidemic of diphtheria. There are families with what appears to be a general tendency to croupous laryngitis. The disease may return. Even tracheotomy has been performed twice on the same individual. It is *contagious*. In the same family, from a case of true croup, either another case of laryngeal croup may originate, or another form of diphtheria will develop in other members of the household. Male are more frequently affected than female children.

SCARLET FEVER.

The annual deaths from this disease are over 16,000; mostly affecting children from one to ten years of age. Children under one year of age often escape, or have the malady in a mitigated form. The appearance of the disease in certain localities, without known exposure, argues that this disease, like diphtheria, may originate from unsanitary surroundings. In the vast majority of instances, however, it does not appear except as the result of exposure of one individual to another sick of the disease, or from contact with infected lodgings, bedding, clothing, etc. Precaution in this regard, and the observance of suitable hygienic measures, will generally prevent the development or spread of this malady. Epidemics tend to recur every five or six years, as a fresh series of the susceptible arises. They often extend with us in dry seasons and subside after wet ones. A defective hygiene from imperfectly drained dwellings and bad ventilation aggravate the type and intensify the infection of the disease. Infection attaches to the entire period of illness. Greatest at the height of the disease, it may be given off for six weeks, and even longer. Strict isolation during this time is of the utmost importance.

DYSENTERY.

The United States census places the annual mortality from this disease at over 13,000. More than two-thirds of the deaths occur with children under five years of age. This affection is evidently influenced in frequency and gravity by heat, not only of hot countries but by that of the summer and autumn in temperate climates; but it is generally admitted that the malady depends on a certain focus of infection, and that it dies out on the removal of the cause. Diarrhea and dysentery are the most frequent scourges of armies. In the United States Army the disorder prevailed to the extent of 209 per 1,000 of the mean strength for 1883. The causes which produce dysentery are similar, if not identical, with those which develop malarial fever, such as moisture, common to habitations on low grounds, foul air, exposure to rain and wet, too light clothing and the influence of the seasons and conditions of the weather, impure water, unwholesome food, cold and damp nights followed by hot days and rapid changes of temperature. The contagiousness or communicable nature of the malady is an unsettled question, but the complete disinfection or destruction of the alvine evacuations may be regarded as a sanitary measure of great importance.

ENTERITIS.

The deaths from this affection are more than 12,000 annually. Children under one year of age suffer over 25 per cent. of the fatality, and with those under five years more than 50 per cent. of the deaths occur. No doubt many of the cases thus reported might have been classed as cholera infantum. In the majority of instances it is due to the same causes that develop this disease, or those which induce dysentery. The disease is much more frequent in the summer, particularly when there is extreme difference between day and night temperature, or when the heat is associated with much moisture. Of exciting causes improper food is by far the most common, especially during the first year of life. Cow's milk alone may at that time be sufficient to induce it, and it is rare for infants of this age to escape an attack.

WHOOPIING COUGH.

The fatality in this affection is seen from the census table to be far greater than that usually supposed, more than 11,000 deaths occurring annually from this cause. But of this number nine-tenths of the deaths are under five years, and more than half under one year of age. This malady occurs in epidemics, chiefly prevalent in the spring, extending over a large part of any town or district associated by various means of inter-communication or by common educational establishments, and spreads as long as *young children* who have not had the disease before are brought within its influence. Certain bodily states—the condition of teething, and that left after measles and some other diseases predispose the mucous surfaces to infection. The infection is often received with that of measles, and the characteristic cough of one disease is not recognized till the rash of the other has passed away. Infection persists for six or eight weeks after the disease is declared. Whooping cough prevails so extensively in early childhood that it is rare to find anyone grown up without having been exposed to it. The writer, however, witnessed an epidemic at Key West in 1866 which affected many of the oldest inhabitants. But, as a rule, those who escape infection in childhood mostly escape it altogether. It is one of the three diseases most fatal to young infants, and like the bronchitis of cold weather and the diarrhea of summer, is, as we have proved, most fatal to the youngest. It differs from the two affections named in not being more fatal in very hot or very cold years. Its fatality in England with children stands next to scarlet fever. In the United States its fatality with children under five years of age exceeds that of scarlet fever. It is more fatal with girls than boys. The intensity of the disease is increased by overcrowding, bad ventilation and the confinement of the sick in close apartments. Guarding young children from exposure to the known infectiousness of the malady would doubtless save thousands of lives, the disease being mild and comparatively free from danger in after years.

BRONCHITIS.

We find from the United States census that nearly 11,000 deaths occur annually from bronchitis. This disease is, no doubt, equally prevalent during the active or middle period of life, but the extremes of life exhibit the greatest fatality, owing mainly to the greater tendency of the inflammation at such periods to extend directly from the bronchioles into the lobules of the lungs, thereby complicating the bronchitis with lobular pneumonia, and, no doubt, in more than half the cases reported under the head of bronchitis the fatal result was caused by pneumonia instead of bronchitis. We find from the above report that more than half the deaths were with children under five years of age, and more than one-fourth after fifty years of age. The chief causes of the malady are exposure to atmospheric temperatures too warm or too cold, or the habitual wearing of too much warm clothing, or that which is insufficient, and especially the unequal adjustment of clothing to different parts of the cutaneous surface. In children especially we often see an abundance of warm clothing over the whole body, while the legs and feet and neck have but a single covering, and sometimes none. Whenever, in order to be fashionable, such children are seen out on cold days with naked legs, from short trousers and defective stockings, it may be safely affirmed that they either have a quack for a physician or a fool for a mother, and possibly both. If the mothers of such children, and others, will persist in sitting by open windows

with low-necked dresses, or on going out loaded with warm clothing, while their feet and ankles are protected only by thin shoes and stockings, they will be pretty certain to contract bronchitis; but while this may be only an annoying spell of sickness to them, the same affection may mean death to their children. Besides, exposure to sudden and extreme changes of temperature, or that which is incident to a cold, damp and variable climate, bronchitis is to be classed among zymotic disorders, since it often occurs in an epidemic form without the presence of an obvious exciting cause. It also occurs in connection with certain general fevers, more particularly with typhoid, measles, influenza, and pertussis. It also sometimes, though more rarely, accompanies rheumatism, erysipelas and constitutional syphilis.

DIARRHŒA.

Over 10,000 deaths annually are recorded in the United States census from this affliction, but if we include those cases under the name of cholera morbus, cholera infantum, and dysentery we find a yearly death of more than 50,000 persons from this class of diseases, 24,000 of them infants under one year of age. With the latter, as we have said, artificial feeding may be recognized as the principal etiological factor. But sanitarians universally agree that in all filthy districts that those diseases especially predominate which, in respect of their leading symptoms, may be generalized as diarrheal. The mucus membrane of the intestinal canal seems to especially bear the stress of all accidental putridities which enter the blood. Whether they have been breathed, or drank, or eaten, or absorbed from the surface of foul ulcers, or directly injected into the blood vessels by the physiological experimenter, this effect may be looked for. Just as alcoholic stimulents, however administered, will get into the head, so septic ferment, entering the blood by whatever route, is almost certain to find its way thence to the bowels, and there, as an inevitable result, produce diarrhea. Rational therapeutics in such cases do not consist so much in checking the often symptomatic disorder (which may be nature's only safeguard) by restraining measures, as in strict sanitation against all those agencies known to exert a causative influence.

MEASLES.

The annual mortality from this disorder is about eight thousand. Of this number nearly one-half the deaths occur with children under two years of age. After this age the mortality is not greater in proportion to the number of attacks than at other periods of life, and there is some advantage in contracting the disease at a time when careful nursing and individual attention can be secured. Those who escape measles during childhood are very likely to be siezed on taking their part in mixed communities. Contagion is the probable cause of measles wherever it is now met with. In large towns, where sources of infection always exist, epidemics recur about every four years, chiefly among children, as a fresh series of the susceptible become exposed. Extremes of temperature, exposure to wet or dampness, malarial soil, vitiated air or crowded dwellings and defective diet are factors which contribute to its fatality. Measles, in a school or family, is sure to spread, as the catarrhal stage, which is infectious throughout, is generally mistaken for a common cold and no timely separation is attempted. Infection begins before the rash appears. After an attack of the measles isolation for at least thirty days should be required. Infection may cling to articles of clothing or linger in closed rooms even longer than this length of time.

REMAINING ZYMOTIC AFFECTIONS.

Septicæmia causes nearly six thousand deaths annually. This affection originates from the introduction of septic or putrid matter into the blood; a poisoning from absorption of the chemical product of putrefaction. Impure air, especially that which emanates from decomposing animal matter, crowding together a number of persons with suppurating wounds, neglect in removing the discharges and excretions from sick persons, and imperfect drainage and the puerperal condition favor the development of this disorder. It may also follow disease of important excretory organs, as Bright's disease, great nervous depression, wounds, local inflammation and is the gravest danger of many surgical operations. Prophylactic measures are suggested by the consideration of the foregoing causes. Scrupulous cleanliness and the integrity and functional activity of the chief excretory organs should be secured in all cases of operation or injury in order that decomposition of the discharge or the accumulation of effete material in the blood may be guarded against.

Scrofula causes five thousand deaths annually, and over fifty per cent. of this mortality is with children under five years of age. But our census does not tell us of the many thousand children annually born into the world with frail constitutions who live on doomed to blindness, deafness and life-long deformity and misery, due to this malady, for in a vast majority of instances it is a disease hereditarily acquired. Its causes mainly lie beyond the conception of the infant, and preventive measures have reference to the marriage of unhealthful individuals, which ought to be controlled in every civilized country by legislative enactment.

Erysipelas causes annually over 4,000 deaths, more than one-third of this fatality also occurring amongst children under five years of age. This affection is undoubtedly infectious and inoculable, as hospital experience has amply demonstrated, but the development of the disease depends, to a great extent, upon the patient and his surroundings. Constitutional predisposition is hereditary, and is increased by previous attacks. Disease of some important viscus, especially liver and kidneys, and the presence of a wound tend to develop the malady. It is said to be most common in women, especially at the menstrual period. Intemperance and want of proper food are great predisposing causes. It is said to be most common in spring and autumn. Of other predisposing causes to be observed and guarded against, overcrowding in hospitals and prisons, lack of ventilation and cleanliness, bad food and impure water should be mentioned as of most importance. Meteorological conditions, as east winds, low temperature, excessive moisture, cold and heat, with attendant perturbation of physiological function may be considered as a cause of its epidemic prevalence, and the type of the disease varies in different outbreaks.

Rheumatism is the cause of over 3,000 deaths annually, the fatality being due, no doubt, to hyperpyrexia, affection of the meninges of the brain, but most generally to complicating heart disease. This disease, like pneumonia and acute bronchitis, belongs to temperate rather than cold climates. It is met with in tropical countries, such as the East Indies and Egypt, but is unknown in the polar regions. Of the predisposing causes, more than one-fourth of the cases can be traced to inheritance. Previous attacks increase its liability to return. It is not uncommon either in children or in persons past middle life. The great majority of first attacks occur, however, under thirty years of age, and the larger proportion between sixteen and twenty-five. Laborious outdoor occupations, in which persons are exposed to cold and wet, poverty, and the many evils associated with these, contribute in furnishing the largest percentage of cases. It is not uncommon in warm weather

on account of frequency of chills from overheating. It may suddenly make its appearance after a sprain, or other injury to a joint, which may also determine the distribution of the disease in articulations. An attack of acute rheumatism is occasionally referred to derangement of digestion, and the function of the liver, especially in subjects who have previously suffered. Indulgence in abundant rich or indigestible food will certainly determine a relapse in persons convalescing from the disease, and may possibly induce an attack in the predisposed. Depressing bodily or mental influences, and, possibly, simple mental despondency, may act in this way in different instances.

Cerebro-Spinal Fever is the cause of nearly 3,000 deaths annually. Of this number over 50 per cent. occur with children under five years of age.

Its development is favored by over-crowding residence in damp localities, foul air and unwholesome food. It is epidemic, but not contagious.

Cholera Morbus causes about 2,000 deaths annually; over 25 per cent. of this mortality is reported among children under five years of age. This malady prevails most extensively in July and August, when the variation of temperature between day and night is great. Exhaustion of the nervous system by heat favors its development as well as mental anxiety and overwork. Unwholesome food, impure water and offensive exhalations from filthy localities are among its principal exciting causes.

Veneral Diseases are reported as causing only about 1,200 deaths annually, but evidently owing to an unwillingness upon the part of individuals or physicians to report the true nature of such maladies this estimate must be very inaccurate. The deaths are mainly due to syphilis; over one-third are among newly-born children under one year of age. It is estimated that in our large cities fully 5 per cent. of all the inhabitants are affected with this disease. The whole number affected with the malady in the United States is believed to be about 2,000,000, while 200,000 prostitutes are permitted to cumber the cities and towns of this country and to propagate the malady absolutely without an effort being made to suppress or control the evil by legislative enactment. It is said that not less than 1,000 persons reduced to pauperism by this disease are supported by public expense in this State. All physicians of experience have witnessed the withering blight of this loathsome disease upon new-born babies, but from considerations of prudence have veiled the fact with the patronizing mercy of their silence. It has been estimated that three-fourths of the deaths of children under five years of age in our larger cities are due to this loathsome malady; surely every thoughtful mind ought to be impressed with the necessity of some efficient measures of arresting, by strict sanitary inspection, this horrible corruption of blood in the constitutions of our race, which is so steadily multiplying the ills and miseries of human life.

Small-pox was the cause of only about nine hundred deaths in the United States in 1880. No better argument than this in favor of protective medicine is possible. This malady during the previous century was justly regarded as the greatest scourge of mankind. Its fatality decimated in every decade the population of Europe. In France, before the discovery of Jenner, the mortality from this disease was 30,000 annually. In other countries it constituted fully one-tenth of their total mortality. To-day only the most ignorant are responsible for the spread of this loathsome plague of former ages. No truth is more fully recognized by all intelligent people than that isolation and disinfection will control the spread of

It pox, and if preventive medicine has demonstrated anything it has most conclusively shown that vaccination (and re-vaccination every six or eight years), generally and systematically performed, will prevent its development.

Two other important zymotic diseases of great fatality did not prevail in 1880. We refer to *cholera* and *yellow fever*. There is no reason why the former should ever be found in this country if its importation is prevented. It can not prevail here except by introduction from foreign lands; but when it exists in Europe it has never yet failed to come as an unwelcome visitor among us. Entering our great seaport towns it is rapidly transmitted by steamboats and railroad cars into the numerous towns and cities located on these channels of travel and commerce. But it is well known that by proper sanitary measures it can be kept out of our country, and even stamped out if by chance it finds lodgment here. Owing, however, to negligence and indifference in this regard our mighty nation did but little to protect our population during its last visitation, and in 1873 it invaded thirteen States and spread terror and desolation among the inhabitants of more than two hundred towns and cities. Neither are we powerless against yellow fever. This malady, too, can be and has been controlled by rigid sanitation. Prior to 1805 it prevailed as far north as Boston, but owing to strict administration of sanitary laws no epidemic of this disease has visited that city during the present generation. The same is true of Providence, Rhode Island. Philadelphia suffered seventeen epidemics of yellow fever prior to 1854; but the sanitary government has kept the city free from that date to this. In New York, prior to 1822, epidemics of yellow fever were frequent and terrible, and in some years destroyed her citizens by thousands. Though the growth and density of the population of New York has been almost the wonder of the world, the sanitary bureau has banished the disease from that city, also, and no epidemic of yellow fever has prevailed in the metropolis for more than a half a century. This absence in any of these cities is not due to lack of facilities for importation. Perhaps not a year passes but what cases of yellow fever are taken from the shipping to the quarantine stations. What these cities have done against this disease, other cities can do, and this is equally true of other contagious and infectious maladies of exotic development. But shall we only dread the pestilence that walketh in darkness, and the destruction that wasteth at noonday? A distinguished Southern physician has well said that if cholera or yellow fever appears in a city in America, the whole country becomes alarmed; but we Americans are absolutely indifferent to other preventable diseases, which yearly produce one hundred times greater mortality than both of these maladies combined. It may be safely affirmed that yellow fever and cholera, which so alarm and horrify our citizens are insignificant in death dealing when compared with the more common diseases over which man has absolute powers of control, and which he makes but little or no effort to prevent or mitigate. In 1873 the total mortality from the former was only 8,000, while in the same year the deaths from malarial, scarlet and typhoid fever, from dysentery, diarrhoea, and cholera infantum, from consumption, measles and whooping cough, aggregate alone no less than 192,000. Is life less valuable because sacrificed by the latter diseases instead of the former? "It is true that the havoc of yellow fever and cholera was far more rapid in destruction, but these diseases rarely afflict us more than once in a decade, while the others are always with us, reaping enormous harvests of death each year."

CONCLUDING OBSERVATIONS.

In order to attain health and longevity we must constantly guard against the malific influence of impurity of atmosphere, water and food, the inheritance of a diseased constitution and exposure to contagious and infectious maladies. But individual effort can exercise but little influence in protection against either of

these factors. The State is the delegated guardian of man's life, as well as his liberty and property. In all sections of this country thousands of infants are annually born into the world inoculated with scrofula, syphilis, consumption, epilepsy, chorea, insanity, or the alcoholic diathesis, and this often to an alarming extent in the highest society of the nation. If the laws of the State are inadequate to prevent the marriage of diseased persons, and protect children from inherited maladies, such wrongs to society should be at least discouraged by an enlightened public sentiment.

Truly has it been said, "The curse causeless shall not come," and in this day of rapid transit the facilities for diffusion of contagious diseases are such as to seriously threaten the welfare of every community. "Failure to exert controlling power over these affections, either through ignorance or negligence, renders the danger to mankind far greater in this period of advanced civilization than in any, even amid the gloom and desolation of the dark ages. No nation on the face of the globe is so constantly threatened with devastation from portable diseases as America. The immigration to this country of people from all the lands of the earth is unprecedented in the history of any other nation. Into our seaports are constantly landed enormous vessels filled with human freight, composed largely of the restless, dissatisfied, turbulent, poverty-stricken, diseased and oppressed people of all climes and nationalities. Into the great harbors of New York, Philadelphia, New Orleans and San Francisco hundreds of thousands of ragged, filthy and penniless new-made sovereigns, with their little bundles packed amid the squalor and diseases of the dangerous homes from which they emigrated, are hastily thrown upon the wharves, and by hundreds of fast boats are carried over thousands of miles of rivers or over the one hundred and twenty-five thousand miles of railroads, and scattered into every community in America, and with them are carried the infectious diseases of the places from whence they came." And without national and State sanitary surveillance, both at ports of departure and upon arrival in our harbors, the commercial stability, peace, prosperity and happiness of every community are daily jeopardized. Thus are these diseases readily brought into our cities, and as soon as one is driven out another stares us in the face, and the only chance for protection in this day is for the municipality to keep skilled and faithful guardians on the alert to meet and conquer these direful affections. From what has been said concerning the predisposing influences of zymotic disease, we find that the best local sanitation against the development of any one specific disease is almost equally valuable against another. For this reason no community is safe from this class of maladies as long as any one of them is prevalent and will afford the best evidence for improved sanitation. No maxims are more true than a "Nation's health is a nation's wealth," and that "Nothing is so costly in all ways as disease."

But public health can only be advanced by organized effort upon the part of municipal, State and National authorities, and fully empowered by law to enforce the requirements of their important trusts. The members of all organizations to secure these results should be chosen entirely with reference to ability and integrity. Children in all public schools should be educated to understand the elemental principles of physiology and hygiene. Legislators should be educated to understand that the prosperity of our nation depends upon the health of its citizens. Engineers and architects should be educated to understand the most perfect sanitary arrangements for sewerage and ventilation in the construction of all residential or public buildings. "Ministers of the Gospel should be educated to know that a violation of the laws of health is a violation of the laws of God, and that when the consumptive, the syphilitic or scrofulous man or woman enters the holy

bonds of wedlock and the issues of such marriages die in infancy and they are called upon to conduct the funeral services, that it is blasphemy to speak of such a death as a manifestation of Divine Providence and loving care of the infant in removing it from future temptation and sin. When zymotic disease is decimating a filthy community, let them not insult God by praying that He will cease to kill the people." Let them remember that nature's inexorable laws are not suspended in this world for man's benefit, and that petitioning for a day of fasting and prayer, to induce the Heavenly Father to save them from pestilence, is inexcusable, if not blasphemous ignorance, as long as towns and cities are reeking with those causes and sources of contagion which breed such maladies.

On the great plains of plague-stricken Asia, centuries before the Christian era, the query: "Shall such ills come by chance?" was then answered—

"Like the sly snake they come
That stings unseen; like the striped murderer
Who waits to spring from the Karunda bush,
Hiding beside the jungle path; or like
The lightning striking these and sparing those,
As chance may send."

Shall the intelligent clergymen of to-day meet this problem with no more rational interpretation than the ancient Buddhists in the earliest dawn of the world's history? We trust not. But it is the physician after all who, by long experience and the acquisition of the accumulated knowledge of the past, who *knows* concerning the causes and prevention of disease, and to him alone is in reality delegated the high and sacred obligation to preach the gospel of health. All accomplished and successful physicians are in these days also intelligent sanitarians. And recognizing that the health of communities and even of nations often depends upon the health of individuals, they, with unselfish devotion to public interest, seek to inculcate among "the laity" all knowledge that experience and observation have taught relating to personal and domestic hygiene, in order that the greatest good may result to the greatest number. Under this policy results of the most important character are constantly being obtained in what is termed public hygiene. Even by the most rudimentary or imperfect methods of sanitation, which as yet alone is practicable, the most terrible forms of disease have been banished. The *plague* and *leprosy* have been practically obliterated in every civilized country, and other contagious and infectious diseases have assumed a much milder form. With more efficient sanitary measures all of the so-called *zymotic* and *specific forms* of disease which have so scourged the world will certainly become more and more rare, if they do not altogether disappear.

